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INTRODUCTION

The objectives of the Environmental Modeling Program at JIAFS, NASA-Langley Research Center for the period April 1, 1980 to August 31, 1982 were to provide a theoretical framework for the interpretation of satellite measurements of stratospheric temperature and trace gases. This problem is quite complicated since the distributions of trace gases are dependent on dynamics and photochemistry. Therefore, the problem was attacked with models employing varying degrees of photochemical and dynamical complexity.

Specific questions addressed were: 1) what is the relationship between dynamics and trace gas transport and how do wave transience, dissipation and critical levels affect the net (permanent) transport of trace gases? 2) what is the role of photochemistry in trace gas transport? 3) how do photochemistry and dynamics alter the mean-zonal distribution of stratospheric ozone? 4) what approximations can be employed to simplify the interpretation of observations and General Circulation Models?

ACHIEVEMENTS

The results of this research were reported in a conference proceedings (Kurzeja, et al, 1980) and three journal papers (Kurzeja, 1981; Kurzeja, 1983; and Kurzeja, et al, 1983).

In Kurzeja (1981), the relationship between transport, dissipation and mean-zonal diabatic heating was explored for the simplest possible case - steady waves with quasi-geostrophic dynamics and Newtonian cooling. An analytic relationship between dissipation and tracer transport was obtained and the results compared to observations. It was found that the transport from steady waves was much less than observed which implied that wave transience and nonlinearities might be important.

In Kurzeja (1983), the transport due to wave transience and critical level formation was examined. The results were a logical extension of the steady-wave results of Kurzeja (1981) but showed additional complexity. For example, transport unique to a critical level was identified and an efficiency "factor" for transport by wave transience derived.

The results obtained with the simple models of Kurzeja (1981, 1983) were applied to the GCM study of Kurzeja et al (1980, 1983). In this model, simple linear chemistry was included in a realistic dynamical model, GCM. Among the many results obtained were the following; photochemistry was shown to be important to much lower altitudes in the stratosphere than previously thought; the influence of dynamics on interhemispheric asymmetries in ozone was demonstrated; the effect of planetary waves on ozone's mean-zonal distribution was shown.

References

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